Self-Paced Calculator Practice for Statistics

Clear and Reset Your Calculator

Clear your calculator before you begin working with it and at the end of your assignments. (Especially if you are borrowing it!) The calculator remembers the state it was in the last time it was used, and all of the old work will still be present.

Press Y= at the top left of the calculator. If there are unneeded equations on the screen,

```
Plot1  Plot2  Plot3
\Y1∎X²+3
\Y2∎X+3
\Y3=∎
\Y4=
\Y5=
\Y6=
\Y7=
```

move the cursor on top of the equation you would like to remove and press CLEAR.

If any of the plots at the top are highlighted,

```
Plot1  Plot2  Plot3
\Y1=
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

press the up arrow key (and left or right if necessary) until the cursor moves to the top of the screen, and the plot you would like to turn off is flashing. Press ENTER to turn the plot off. Note: the word Plot will still be flashing (although in a

slightly different way), but if you push the down arrow key you will see that the word plot is no longer highlighted.

Your Y= screen is ready to go!

```
Plot1  Plot2  Plot3
\Y1=
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

To clear the STAT data-entering screen, press STAT and then ENTER on the first choice which is 1:Edit. For all menus on the calculator, you may push the number next to the choice instead of moving the cursor down and selecting with ENTER. If there are unused numbers on the screen,

```
L1       L2       L3        1
8        11       ------
7        2
6        31
5        15
------   ------
L1(1)=8
```

push the up arrow until the cursor goes to the top of the column you would like to empty. The L heading will be highlighted. Press CLEAR and ENTER and the column will become blank. (Do not push DEL!) Repeat for all columns with data you do not need.

It is important that the L numbers at the top of this screen count up from 1! If you are missing any L numbers,

```
     L3     L4      1
 11    ------  ------
 2
 31
 15
 ------

L2 = {11, 2, 31, 15}
```

push STAT and then choose 5:SetUpEditor. Press ENTER to run this command.

When you push STAT and 1:Edit, if your screen looks like this:


```
L1     L2     L3      1
      ------  ------



L1(1) =
```

then you are ready to work. Try this for yourself!

r value (one time only!): Near the end of your statistics semester, there is a helpful value that will only show up on the calculator if it is switched on. You will not need to repeat the following process unless you take the batteries out of your calculator.   Press 2ND and then the zero key (for CATALOG). Push the x^{-1} key on the left side of the calculator. This will advance the list to entries starting with 'D'. Arrow down to DiagnosticOn and press ENTER. Press ENTER again to run the command. The calculator will say 'Done'.

Enter a Single List of Numbers

To work with a list of numbers, press STAT and then 1:Edit. Generally, you will enter the numbers in the L1 column. Pressing the down arrow or ENTER will finalize each number you have typed and move to the next row. Note: you can clear an entire column by moving up to the L heading and pushing CLEAR, ENTER. When you enter your numbers correctly, it will look like this.

```
L1        L2        L3       1
12       ------    ------
23
55
88

L1(5)=
```

2ND, QUIT will get you back to the main calculator screen, or you can immediately hit a button to take you to your next activity.

1-Var Stats

1-Var Stats will give you a summary of information about a single set of numbers. After you enter your data in STAT, 1:Edit, push the STAT key again. Press the right arrow on the directional pad to get to the CALC menu, and then choose 1:1-Var Stats. This will bring you back to the main calculator screen and add the appropriate command to the screen. If you want to use data from L1, simply press ENTER. You may also choose a different data column by adding the name of the column (for example L2) after the command. To access the L names, use 2ND and the number keys. After you execute the command with ENTER, use the up and down arrows to scroll through the resulting 1-Var information. (Note: if you get an error like ERR:SYNTAX, there was already something written on the main calculator screen when you made the 1-Var Stats command. Press ENTER to clear the error and try again. It will work the second time.)

```
1-Var Stats              1-Var Stats
 x̄=44.5                  ↑n=4
 Σx=178                    minX=12
 Σx²=11442                 Q₁=17.5
 Sx=34.25881882            Med=39
 σx=29.6690074             Q₃=71.5
↓n=4                       maxX=88
```

See below for a description of these statistics. (You will learn what they mean in class.)

$\bar{x}$: mean

∑x: sum

∑x^2: sum of squares

Sx: standard deviation (this is the one you will usually use in class!)

σx: standard deviation (when the data is a population, not common)

n: how many numbers there are

minX: smallest number

Q$_1$: first quartile

Med: median (same as Q$_2$, second quartile)

Q$_3$: third quartile

maxX: largest number

Practice 1: Enter the numbers 3,5,8,9 into STAT, Edit and then find the 1-Var Stats for these numbers. Answers to all practice questions are at the end of this packet.

1-Var Stats with Frequencies

1-Var Stats will also work when you have frequency counts for your data. For instance, if your data is 2,2,2,2,5,5,5,6,6 you can enter each unique number in L1 and the number of times it appears in L2.

```
L1        L2        L3        2
  2         4         ------
  5         3
  6         2
  ------    ▄▄▄▄▄▄

L2(4) =
```

Use STAT, CALC, 1: 1-Var Stats as before. When the 1-Var Stats command is on the screen (and before you press ENTER!), you must tell the calculator to find the data in L1 and L2. Push 2ND and then the 1 button. Next press the comma button in the middle left of the calculator's keypad. Finally add L2 using 2ND and then the 2 button. The final command should look like:

```
1-Var Stats L₁,L
2
```

The 2 in 'L2' might wrap to the start of the next line, but that is ok! Press ENTER to run the command and see your statistics.

```
1-Var Stats              1-Var Stats
 x̄=3.888888889           ↑n=9
 Σx=35                    minX=2
 Σx²=163                  Q₁=2
 Sx=1.833333333          Med=5
 σx=1.728483243          Q₃=5.5
↓n=9                     maxX=6
```

Practice 2: Find the 1-Var Stats for the numbers 7,7,7,9,11,11.

Box Plot

A box plot is an excellent way to see many of the statistics from 1-Var Stats in a visual way. These values are called the 'five number summary'. You will learn more about this in your class.

To make a box plot, first enter your data in STAT, 1:Edit. For this example, enter 3,5,8,9,12,20. Make sure the Y= screen is empty of old settings and equations. See the 'Clear and Reset Your Calculator' section for more information. Next, press 2ND and then choose STAT PLOT by pushing the Y= key.

Pressing ENTER on this screen will choose which plot to work with. For now, push enter on the 1:Plot1 or press the number 1. On the next screen, move the cursor to 'On' and use ENTER to turn Plot 1 on. (This will also highlight Plot1 at the top of the Y= screen. Plots may be turned on and off from either location.) Press the down arrow once to get to Type and then right to the 5th option (which is the middle bottom one.) Push ENTER. If necessary, enter the name of the column with your data next to Xlist. In this case it should read L_1.

To see your box plot, push the ZOOM button at the top of the calculator, and then pick 9:ZoomStat by scrolling to the bottom of the list. You may also immediately press the 9 button instead.
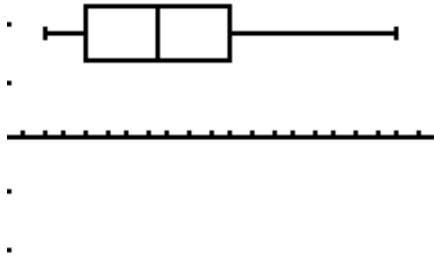
Remember to turn off Plot1 when you are done. You can do that from the top of the Y= screen or by going into STAT PLOT.

Practice 3: Create two box plots at once in order to compare two sets of data! Enter 1,6,7,8,9 into L1. Enter 1,2,3,6,9 into L2. Use STAT PLOT to turn on both Plot1 and Plot2 and set them to the box plot Type icon. Make sure to change the Plot2 Xlist to L2.
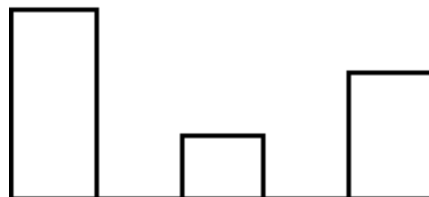
Histogram

A histogram is a plot of the frequency of data. To make a histogram of data that has been entered into STAT, 1:Edit, follow the same steps for making a box plot. (see above) When choosing the 'Type' icon, use the third option that looks like a bar graph. Try this using the numbers 2,2,2,3,4,4, and compare to the results below.

You can use the TRACE button (at the top right of the calculator) to get information about the histogram.

Practice 4: It is also possible to make a histogram using frequency counts in L2. Try to make the same graph as above, but using the numbers 2,3,4 in L1 and the number of times they occur in L2. Hint: when setting up STAT PLOT, set the 'Freq' to L2.

Factorial, Combination, and Permutation

The calculator can help you with these topics involving counting and probability. You can recognize factorial from the ! operator. For example 4! means '4 factorial'. It is calculated by multiplying all integers together from 4 down to 1. So 4! = 4x3x2x1 = 24. You can find factorial on the calculator using the MATH button on the left side. Let's compute 5!. Go to the main calculator screen (you may need to push 2ND, QUIT) and enter the number 5. Then press MATH, move right to the PRB menu using the right arrow, and choose 4:!. Push ENTER to see the answer.

```
MATH NUM CPX PRB        5!
1:rand                              120
2:nPr
3:nCr
4:!
5:randInt(
6:randNorm(
7:randBin(
```

One notation for combination and permutation is nCr and nPr. These math functions will count the number of ways a group can be chosen or a list of items can be ordered. In class, numbers will replace the n and the r, but in the calculator, the numbers will go around the outside. For example, 5 nPr 3 will tell you the number of ways you can start with 5 books and choose to order 3 of them on a shelf. You will learn more about what this means in class. For now, use the calculator to find the result of 5 nPr 3. Start on the regular calculator screen. Enter the number 5 first. Then, push MATH, PRB, and 2:nPr. Finally, add the number 3 and press ENTER.

```
5 nPr 3
                    60
█
```

Calculating combination is the same, except use 3:nCr.

Practice 5: Calculate the following values using MATH, PRB:

8!

10 nCr 4

10 nPr 4

Binomial Distribution

The binomial distribution can tell you the probability of an event occurring a certain number of times out of an overall number of attempts. For example, you can find the probability that you will get 7 heads when you flip a coin 10 times. To use the binomial distribution, first press the 2ND button followed by the VARS button. VARS is in the upper right of the calculator near the directional arrows, and you will see DISTR written above it. Scroll down this list until you get to A:binompdf(and B:binomcdf(. The difference between the two functions relates to the number of outcomes you would like the probability for.   Each function takes three numbers: n,p,r.

n = number of tries (called trials)

p = probability of success

r = the number of successes you are interested in

For example, let's find the probability of flipping 7 heads out of 10. Choose A:binompdf(from the DISTR menu. Fill in 10, .5, 7. We are flipping 10 times, each flip has a .5 chance of being heads, and we want to know the probability of getting 7 heads. Try it! The answer is 0.117. B:binomcdf(will tell you the probability of getting a certain number of successes or fewer. Try it with the same numbers from above to find the probability of flipping 10 coins and getting 7 or fewer heads. This is a higher probability!

```
binompdf(10,.5,7
)
            .1171875
binomcdf(10,.5,7
)
            .9453125
■
```

Practice 6: If there is a 60% chance of rain each day this week, what is the probability that it will rain on exactly 3 days? What is the chance it will rain on all 7? What is the chance it will rain on 2 or fewer days? Remember to enter the probability of rain on each day as a decimal.

Normal Distribution

The normal distribution is called a bell-shaped curve. It governs many measurements you can take in the world including the probability someone will be a certain height and the outcomes of random samples. When using the calculator, you will specify a low and high end of the range you are interested in. You will also provide two more numbers which are called mean and standard deviation. The calculator will tell you the proportion of the distribution that the range includes. This can also be thought of as a probability. For example, assume that the mean height of men is 60 inches, and the standard deviation is 4. The calculator can tell you the probability that a random man is between 55 and 58

inches tall. Start by using 2ND, DISTR and then pick 2:normalcdf(. Enter the low and high end of the range, the mean, and the standard deviation separated by commas. ENTER will run the command and show the probability.

```
normalcdf(55,58,
60,4)
       .2028876933
```

It is also possible to use an open ended range. The trick is to use a very large or very small number. Find the probability that a random man is taller than 67 inches. Use a range of 67 to 99999.

```
normalcdf(67,999
99,60,4)
       .0400591135
█
```

Practice 7: Bottles of soda from a factory are filled to a mean of 12.1 oz with a standard deviation of .1 oz. What is the probability that a random bottle will be filled with between 12 and 12.5 oz of soda? What is the chance it will be less than 12 oz? Hint: for the second part, use a very negative number as the bottom of the range.

Inverse Normal Distribution

Using the inverse normal distribution works the same as the normal distribution but in reverse. For example, the normal distribution can tell you what proportion of men are shorter than 55 inches. The inverse can tell you the height that 90% of men are shorter than. Assume as above that the average height is 60 and the

standard deviation is 4. Use 2ND, DISTR, and then select 3:invNorm(. Fill in .9,60,4).

```
invNorm(.9,60,4)
        65.12620627
■
```

90% of men would be shorter than 65 inches according to our assumed mean and standard deviation.

Practice 8: Assume a mean of 60 and a standard deviation of 4. What height are only 10% of men shorter than?

Tests and Intervals

Statistical tests and confidence intervals are located in the same menu. Push the STAT button and then move right to the TESTS section.

```
EDIT CALC TESTS
1■Z-Test…
2:T-Test…
3:2-SampZTest…
4:2-SampTTest…
5:1-PropZTest…
6:2-PropZTest…
7↓ZInterval…
```

A statistical test will allow you to verify the truth of a claim. A confidence interval is an estimate of a value. Most problems that require an interval will specifically use that word in the question. Choose Z-Test from the menu.

```
Z-Test
 Inpt:Data Stats
 μ0:50
 σ:10
 x:45
 n:22
 μ:≠μ0 <μ0 >μ0
 Calculate Draw
```

Tests have a choice of 'Data' or 'Stats'. Pick data if you are going to enter numbers into a STAT, 1:Edit column. Choose stats if you are going to enter summary statistics from the problem. Select stats now. Enter mean and standard deviation on the next two lines. For this example, enter 50 and 10. Next, x-bar will be 45, and n is 22. Finally, choose < from the options at the bottom. Highlight 'Calculate' and press ENTER.

```
Z-Test
 μ<50
 z=-2.34520788
 p=.0095082177
 x=45
 n=22
```

The p value tells you the probability that the sample might occur assuming the true mean is 50. You will learn much more about this in class, but it is helpful to become familiar with entering this information into the calculator.

Next, go to STAT, TESTS, 7:ZInterval.

```
ZInterval
 Inpt:Data Stats
 σ:10
 x:45
 n:22■
 C-Level:.95
 Calculate
```

The numbers you entered during the last example will already be present. Select calculate.

```
ZInterval
 (40.821,49.179)
 x̄=45
 n=22
```

■

There is a 95% confidence that the true value is between 40.8 and 49.2. Try out some other options on the STAT, TESTS menu. They work in a similar way.

Additional Resources

There are many helpful videos and other examples available. The addresses below will allow you to practice further.

http://media.pearsoncmg.com/aw/aw_mml_shared_1/statistics/TechnologyTutorial/studycard_gc_videolaunch.html

http://media.pearsoncmg.com/aw/aw_agresti_as_learning_data_3/tech_manuals/gcm/ast3e_gcm_manual.html

http://media.pearsoncmg.com/aw/aw_mml_shared_1/gc_tutorial_stats/start.html

Answers to Practice Questions

Practice 1)

```
1-Var Stats
 x̄=6.25
 Σx=25
 Σx²=179
 Sx=2.753785274
 σx=2.384848004
↓n=4
■
```

```
1-Var Stats
↑n=4
 minX=3
 Q₁=4
 Med=6.5
 Q₃=8.5
 maxX=9
■
```
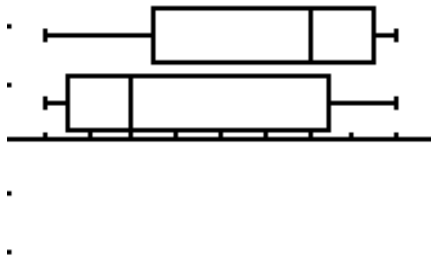
Practice 2)

```
L1      L2      L3      2
 7       3      ------
 9       1
 11      2
------

L2(4) =
```

```
1-Var Stats
 x̄=8.666666667
 Σx=52
 Σx²=470
 Sx=1.966384161
 σx=1.795054936
↓n=6
```

```
1-Var Stats
↑n=6
 minX=7
 Q₁=7
 Med=8
 Q₃=11
 maxX=11
```
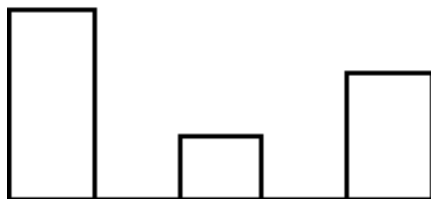
Practice 3)

Practice 4)

Practice 5)

```
8!
                    40320
10 nCr 4
                      210
10 nPr 4
                     5040
```

Practice 6)

```
binompdf(7,.6,3)
             .193536
binompdf(7,.6,7)

█           .0279936
```

```
binomcdf(7,.6,2)
             .096256
█
```

Practice 7)

```
normalcdf(12,12.
5,12.1,.1)
       .8413130544
normalcdf(-9999,
12,12.1,.1)
       .1586552596
```

Practice 8)

```
invNorm(.1,60,4)

      54.87379373
```